



# HEALTH OF BOSTON 2023

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THE HEART DISEASE REPORT

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## FOREWORD

Welcome to the Boston Public Health Commission's (BPHC) Health of Boston 2023: The Heart Disease Report. This is one of a series of reports providing disease-specific surveillance data on the health of Boston. It aims to provide residents, medical and public health professionals, health policy makers, and community advocates with actionable information on the heart disease experience of Boston residents.

The report highlights trends in hypertension prevalence and heart disease hospitalizations and mortality. Data sources include the US census, death registries, hospital inpatient discharge databases, and surveys that describe individual health conditions and behaviors of both housed and unhoused Boston residents.

Individual characteristics and behaviors play an important role in health outcomes, and positive changes in individual behavior related to diet and exercise can reduce the risk of developing heart disease. It is important, however, to acknowledge that individual behaviors are inextricably linked and often limited by the social and economic context of an individual's life. In addition to these social and economic determinants, lifelong exposure to varying forms of racism and discrimination may cause prolonged stress, which can also adversely impact health outcomes. Compounding these inequities, heart disease is a risk factor for more severe cases of COVID-19, resulting in higher rates of COVID-19 hospitalization and mortality among Black and Latinx residents.

Boston Public Health Commission acknowledges the role of racism in creating and perpetuating systems of oppression that undermine the social determinants of health and have resulted in the historic marginalization and subsequent inequities in health outcomes of Boston residents of color.

For many indicators, trends over time are highlighted, as well as differences across neighborhoods and between racial and ethnic groups and other subgroups (e.g., employment, education, and housing status). In addition, a potential association between heart disease and COVID-19 mortality is presented. We hope you find the information presented here useful in your own efforts to educate, inspire, advocate, and intervene in the interest of optimal health for all Boston residents.



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## INTRODUCTION

This report highlights trends in hypertension prevalence, heart disease hospitalizations, and heart disease mortality. Types of data used include the US Census, death registry, hospital inpatient discharge databases, an adult health survey that describes individual health conditions and behaviors, and a survey that describes health conditions and behaviors of individuals experiencing homelessness in Boston. It is part of a series of reports providing surveillance data on the health of Boston residents. This report aims to provide residents, medical and public health professionals, health policy makers, and community advocates with actionable information on the hypertension and heart disease experience of Boston residents.

### **What is hypertension and heart disease?**

Hypertension, also known as high blood pressure, is a major risk factor for heart disease. As blood is pumped throughout the body, it generates a force against the walls of the blood vessels. This force is known as blood pressure. A healthy person's blood pressure varies with age and also fluctuates within a normal range throughout the day (1). Differences have been observed by biological sex, with males consistently having higher levels of high blood pressure compared to females. Blood pressure is recorded as two numbers: the first number which is usually higher is called systolic pressure and the second and usually lower number is called diastolic pressure. In 2017, the American College of Cardiology and the American Heart Association published updated guidelines for hypertension management and defined hypertension (high blood pressure) as a blood pressure at or above 130/80 mmHg. Stage 2 hypertension is defined as a blood pressure at or above 140/90 mmHg (1). A person with high blood pressure may not have any other physical signs or symptoms until they develop a serious health complication. Related complications such as heart disease, heart attack, stroke, heart failure, kidney disease, and peripheral artery disease can be lessened or even prevented through early diagnosis and management of high blood pressure (1).

Heart disease is an umbrella term that covers several conditions related to the heart, including coronary artery disease, arrhythmias, and heart failure. The most common type of heart disease in the US is coronary artery disease (CAD) (2). CAD is caused by cholesterol deposits that build up in the blood vessels that supply the heart with blood. As these deposits accumulate over time, the blood vessels narrow, and blood flow is reduced. Symptoms of heart



disease depend on the specific condition, but worrisome symptoms include heaviness or pressure in the chest, shortness of breath, and feeling weak or lightheaded (2). Nationally, the age-adjusted prevalence of heart disease in adults ages 18 and over decreased from 6.2% in 2009 to 5.5% in 2019 (3).

**Populations at increased risk for hypertension and heart disease:**

In the United States, 32% of adults have hypertension (4). High blood pressure and heart disease are highly associated with increasing age. Risk factors for both hypertension and heart disease include diabetes, overweight/obesity, diet with few fruits and vegetables, physical inactivity, smoking, and excessive alcohol use (2,5,6). Educational attainment and household income are inversely related with CAD and hypertension (7).

**Prevention of hypertension and heart disease:**

Lowering blood pressure, quitting smoking, exercising regularly, reducing stress, maintaining a healthy diet, and avoiding excessive alcohol use can help reduce the risk of developing hypertension and subsequent heart disease (2,5,6).

**Racism and heart disease:**

Inequitable access to safe and affordable homes and neighborhoods, high quality education, gainful employment, and health services disproportionately predisposes people to poor cardiovascular outcomes (8,9). For example, historical racist laws have led to people of color living in under resourced neighborhoods at higher rates than their white counterparts, putting them at increased risk for cardiovascular disease (8). Less education frequently results in fewer opportunities for employment and lower income, which contributes to inequities in healthy behaviors, food security, and health care access, all of which influence the risk or severity of cardiovascular disease. Less education can also contribute to low health literacy, less access to information on risk factors, and challenges with patient-provider communication making it difficult to adopt healthy behaviors and ensure proper medication usage (8).

Structural racism perpetuated by policies and practices has led to people of color not being able to equitably access advancements in cardiovascular care. People of color with cardiovascular disease experience disparities in quality of cardiovascular disease care and health care access (including insurance coverage) (8). One pertinent study using data from a nationally representative survey found that Black people living in states determined to have high levels of structural racism were more likely to report myocardial infarction in the past year compared with Black people living in low-structural racism states (9). Additionally, there is increasing evidence that perceived discrimination and racism are associated with both hypertension (10) and other forms of cardiovascular disease (11).



### **COVID-19 and heart disease:**

Cardiovascular diseases such as heart failure, coronary artery disease, cardiomyopathy, and possibly hypertension can increase COVID-19 severity (12). A meta-analysis showed that cardiovascular disease was associated with poor prognosis of COVID-19 and coronary heart disease was related to increased COVID-19 mortality, severe COVID-19, ICU admission, and disease progression (13,14). This association is further affected by hypertension (14).

## **METHODS**

This report presents data related to heart disease among Boston residents from 2015 to 2021 derived mainly from four data sources: (1) Boston adult hypertension prevalence data are from the Boston Behavioral Risk Factor Surveillance System (Boston BRFSS), Boston Public Health Commission (BPHC); (2) Boston adults experiencing homelessness hypertension prevalence data are from the Health of Boston Survey of People Experiencing Homelessness, BPHC; (3) Boston resident heart disease hospitalizations are from the Case Mix Databases, Massachusetts Center for Health Information and Analysis; and (4) Boston resident heart disease mortality data are from the Massachusetts Resident Death files, Massachusetts Department of Public Health. Data from these four sources were analyzed and presented in a manner seeking to maximize their contribution towards furthering our understanding of the Boston resident experience of heart disease.

Adult hypertension prevalence data from the Boston BRFSS are derived from random sample surveys with approximately 3,000 respondents and administered approximately every other year as specified from 2015 to 2021. The resulting data from the past four survey years were adjusted (i.e., weighted) to permit generation of rates (i.e., percentages) that represent the entire Boston resident population of adults living in households. In some cases, survey data for multiple years were combined to increase stability of estimates. Logistic regression was used to determine the direction of change over time (i.e., increasing, decreasing, or stable) and to compare two demographic groups within a given time period ( $p < 0.05$ ).

Except for age-specific rates, hospitalization and mortality rates within this report are age-adjusted to permit comparisons that mitigate the impact of differences in age distributions of their respective underlying populations. The resulting comparisons allow consideration of observed differences in terms of factors other than population age differences.

For Boston hospitalization and mortality comparisons, rate change over time for the five years (2017-2021) and rate differences between two demographic groups for the most recent year or time period were assessed using statistical procedures. Whether hospitalization and mortality





rates increased or decreased was determined by assessing linear change across the entire 5-year time period using Poisson regression ( $p < 0.05$ ).

Similarly, a rate for a given demographic group is described as higher or lower than the comparison group (i.e., reference group) only when the comparison test indicated statistical significance ( $p < 0.05$ ). When two rates were compared and the difference was not found to be statistically significant, the two rates are described as “similar” if mentioned in text.

Demographic group differences for heart disease hospitalizations and mortality were based on a comparison of single-year rates for the most recent data year, 2021.

Boston population data used as denominators in the rate calculations were produced internally by the BPHC Population Health and Research Boston Population Estimates Project (B-PEP). B-PEP uses 2010 and 2020 US Census data and 2019 American Community Survey data for Boston was used to generate population estimates for years between the 2010 and 2021 via interpolation and extrapolation of age, race/ethnicity, sex, and neighborhood population change from 2010 to 2020. For more information on B-PEP, please contact the BPHC Population Health and Research office. Of note, B-PEP population estimates will be revised as the US Census Bureau releases further delineated 2020 Census population data.

All racial and ethnic designations except those from the death certificate, some hospital discharge data, and some emergency department data are self-reported. Several cautions should be kept in mind when using data reported by race/ethnicity. Race and ethnicity are social constructs, not biological facts. There is often more genetic variation between members of the same race than between members of different races. In addition, the meanings of these designations are highly subject to historical, cultural, and political forces. Not only do these designations change over time, but there is also a very subjective element that influences who is considered a member of one group or another. The concept of race can be notably broad: the term “Black,” for example, includes people describing themselves as African American, African diaspora, or Caribbean, groups with distinct histories and differing health risks. Nevertheless, racial designations are useful in that they are nearly universally used by people in the United States to describe themselves, and they permit us to identify and address health inequities that exist across racial and ethnic groups.

For racial/ethnic group comparisons we used White residents as the reference group and assessed the difference between each non-White resident group rate (e.g., rate for Black residents) and the White resident (reference group) rate. For sex-based comparisons, males were the reference group. Neighborhood comparisons involved assessing the difference between a given neighborhood’s rate and the rate for the rest of Boston (those residents not living in the specified neighborhood). These comparisons are considered more accurate than comparisons to Boston overall.



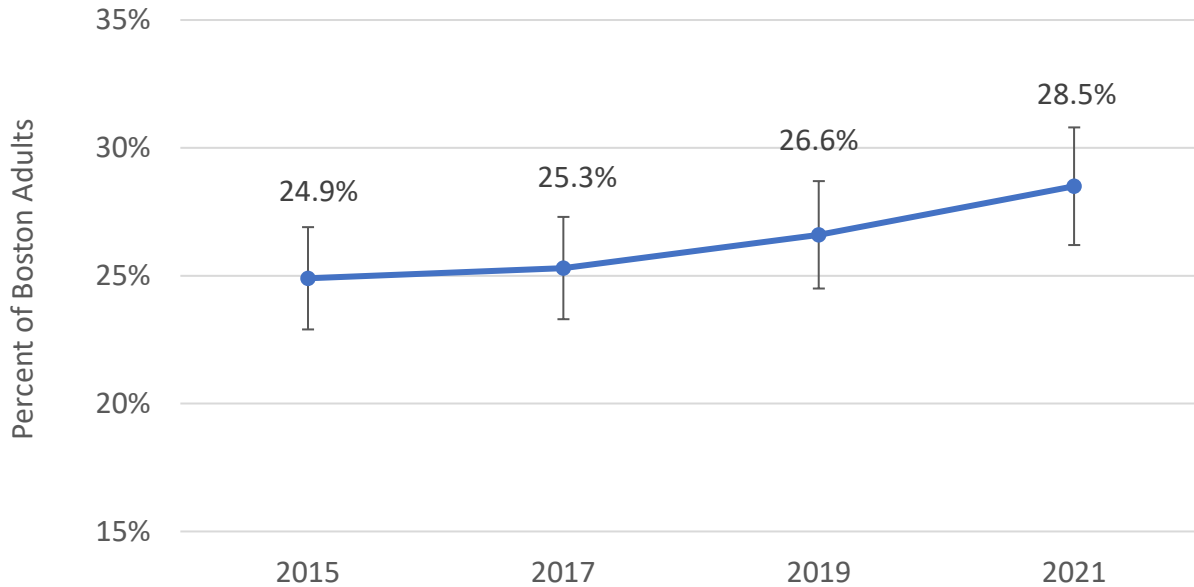


Hispanic and or Latinx people can be of any race. In this report, data for persons of Hispanic and/or Latin descent are described as Latinx and presented alongside non-Latinx racial groups. Boston-specific data by race and Latinx ethnicity is presented for non-Latinx Asian residents, non-Latinx Black residents, non-Latinx White residents, and Latinx residents of any race. Few sources have data in large enough counts to allow presentation of data about smaller groups such as the many ethnicities included under the category “Asian.” Additionally, small survey sample size and case numbers limit the ability to identify and describe health disparities for Indigenous people.

For additional information regarding the analytical methods used within this report, please contact the Boston Public Health Commission Population Health and Research Office.

## SECTION 1. HYPERTENSION PREVALENCE

**Figure 1. Hypertension Among Adults by Year, 2015-2021**

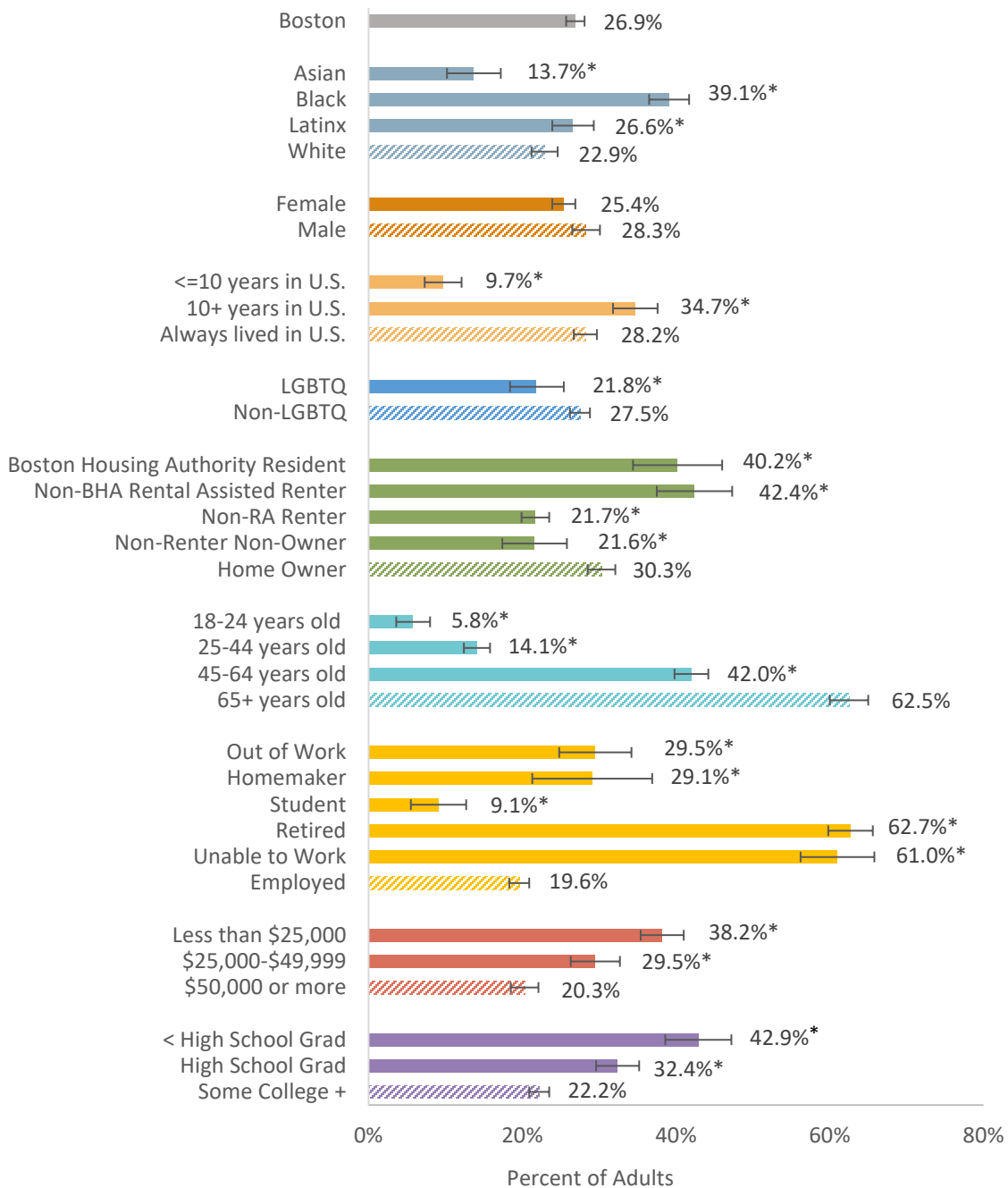


DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2015, 2017, 2019, 2021), BPHC

The hypertension rate among Boston adults was stable from 2015 to 2021. In 2021, the prevalence of hypertension among Boston adult residents (28.5%) was lower than that reported for Massachusetts (29.9%) and the US (32.2%) (4). These comparisons have not been tested for significance.

Of note, in 2017, the American College of Cardiology and the American Heart Association published new guidelines for hypertension management and defined high hypertension as a blood pressure at or above 130/80 mmHg compared with 140/90 mmHg previously. The lowering of the thresholds for hypertension likely results in increasing numbers of diagnoses in the years subsequent to 2017.

**Figure 2. Hypertension Among Adults by Selected Demographics, 2017, 2019, 2021 Combined**



\* Statistically significant difference when compared to reference group

NOTE: Bars with hatch marks indicate the reference group within each selected indicator.

DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2017, 2019, 2021), BPHC

As with most chronic diseases, hypertension rates are highly influenced by age composition, as hypertension rates increase with age. The hypertension rates in Figure 2 should be considered unadjusted or “crude” rates, reflecting the adult population among Boston residents living in households. Rate differences among the selected demographic’s categories do not account for age group differences among those categories.

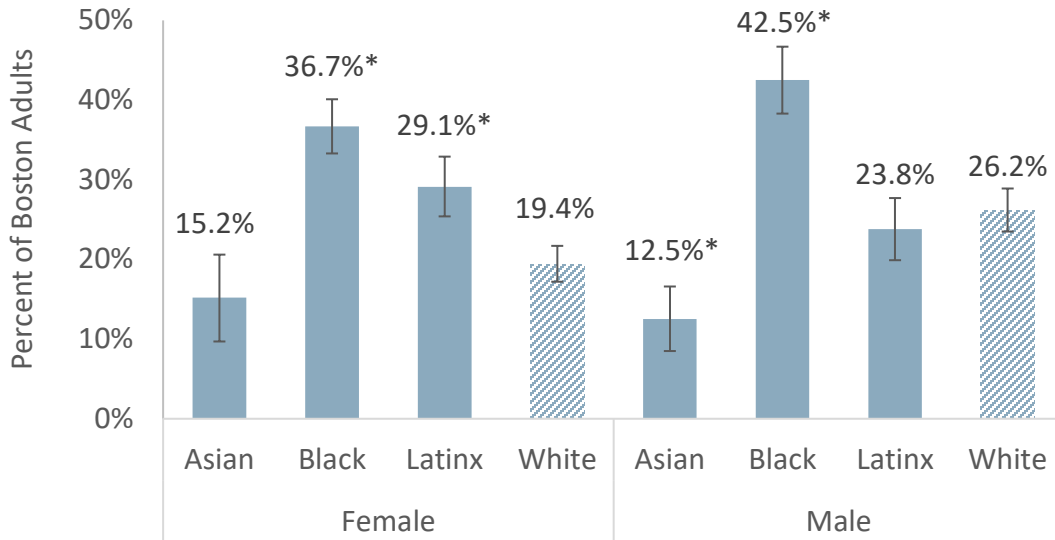
During 2017, 2019, and 2021 combined, 26.9% of Boston adult residents reported having hypertension. The percentage of residents with hypertension was higher than the reference group for :

- Black (39.1%) and Latinx (26.6%) adults compared with White adults (22.9%)
- Foreign-born adults who lived in the United States for over 10 years (34.7%) compared with those who were born in the United States (28.2%)
- Adults who were Boston Housing Authority residents (40.2%) and renters who received rental assistance (42.4%) compared with adults who owned a home (30.3%)
- Adults who were unable to work (61.0%), retired adults (62.7%), homemakers (29.1%), and adults who were out of work (29.5%) compared with adults who were employed (19.6%)
- Adults living in households with an annual income of less than \$25,000 (38.2%) or \$25,000-\$49,999 (29.5%) compared with adults living in households with an annual income of \$50,000 or more (20.3%)
- Adults with less than a high school diploma (42.9%) and adults with a high school diploma (32.4%) compared with adults with at least some college education (22.2%)

The percentage of adults with hypertension was lower than the reference group for:

- Asian adults (13.7%) compared with White adults (22.9%)
- Female adults (25.4%) compared with male adults (28.3%)
- Foreign-born adults who lived in the United States for 10 years or less (9.7%) compared with those who were born in the United States (28.2%)
- LGBTQ adults (21.8%) compared with non-LGBTQ adults (27.5%)
- Adults who rented but did not receive rental assistance (21.7%) and adults who neither rented nor owned their home (21.6%) compared with adults who owned a home (30.3%)
- Adults ages 45-64 (42.0%), 25-44 (14.1%), and 18-24 (5.8%) compared with adults ages 65+ (62.5%)
- Adults who were students (9.1%) compared to employed adults (19.6%)

**Figure 3. Hypertension Among Adults by Race and Sex, 2017, 2019, 2021 Combined**



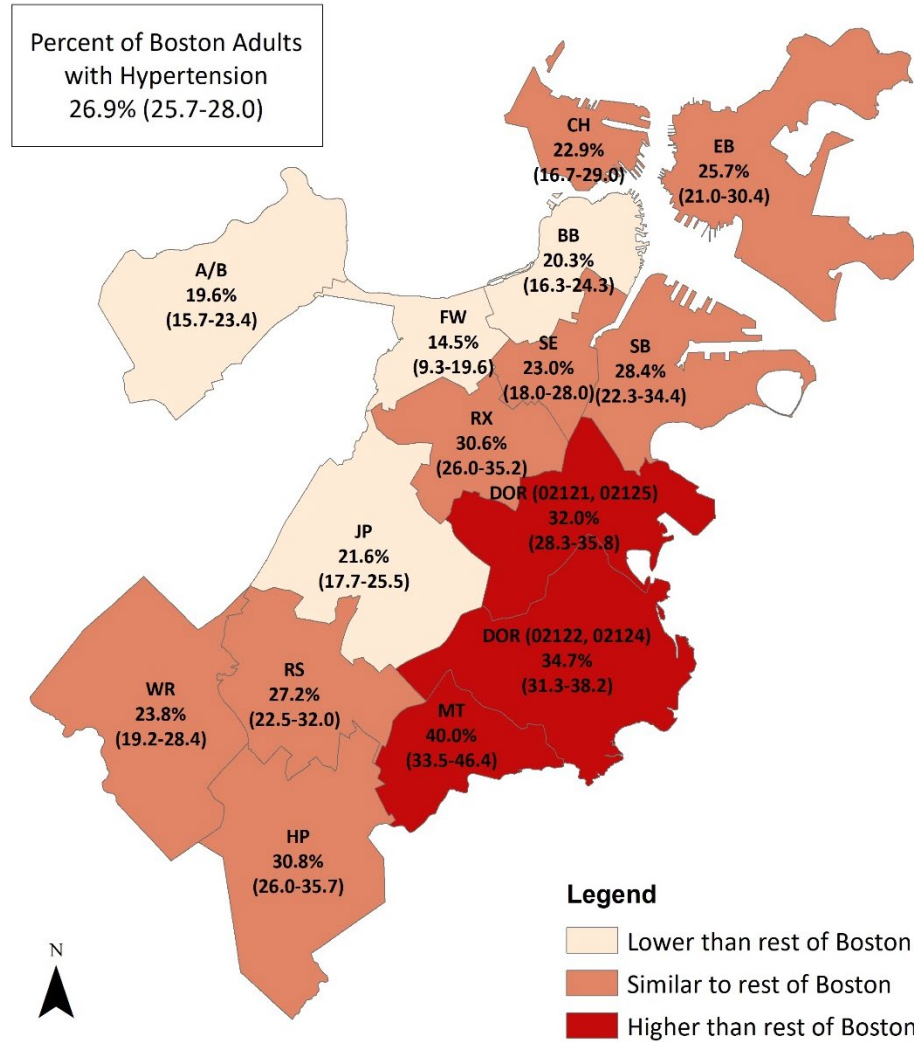
\* Statistically significant difference when compared to reference group

NOTE: Bars with hatch marks indicate the reference group within each selected indicator.

DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2015, 2017, 2019, 2021), BPHC

In 2017, 2019, and 2021 combined, a higher percentage of Black female (36.7%) and Latinx female (29.1%) adults had hypertension compared with White female adults (19.4%). A higher percentage of Black male adults (42.5%) had hypertension compared with White male adults (26.2%). A lower percentage of Asian male adults (12.5%) had hypertension compared with White male adults.

**Figure 4. Hypertension Among Adults by Neighborhood, 2017, 2019, 2021 Combined**



DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2017,2019,2021), BPHC

During 2017, 2019, and 2021 combined, the percentage of Boston adult residents with hypertension was lower in Allston/Brighton, Fenway, Back Bay (includes Back Bay, Downtown, Beacon Hill, West End), and Jamaica Plain compared with the rest of Boston. The percentage of adults with hypertension was higher in Dorchester 02121, 02125, Dorchester 02122, 02124, and Mattapan compared with the rest of Boston. The neighborhood with the highest percentage of hypertension, Mattapan was over double the rate for the neighborhood with the lowest percentage, Fenway.

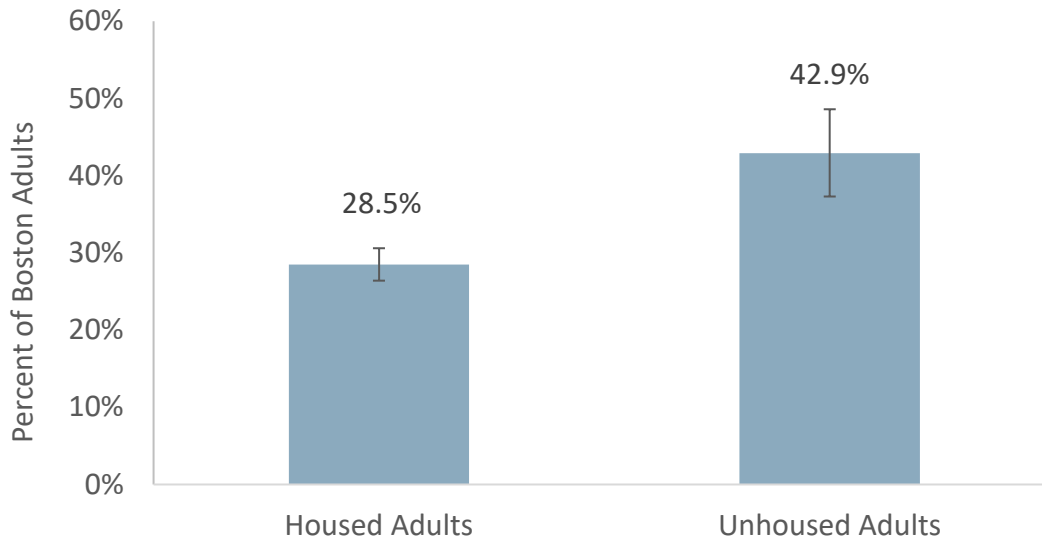
**Table 1. Hypertension by Neighborhood, Ranked in Descending Order, 2017, 2019, 2021 Combined**

<b>Neighborhood</b>	<b>Estimate</b>	<b>95% Confidence Intervals</b>
Mattapan (MT), 02126	40.0	(33.5-46.4)
Dorchester (DOR), 02122, 02124	34.7	(31.3-38.2)
Dorchester (DOR), 02121, 02125	32.0	(28.3-35.8)
Roxbury (RX), 02119, 02120	30.6	(26.0-35.2)
Hyde Park (HP), 02136	30.8	(26.0-35.7)
South Boston (SB), 02127, 02210	28.4	(22.3-34.4)
Roslindale (RS), 02131	27.2	(22.5-32.0)
East Boston (EB), 02128	25.7	(21.0-30.4)
West Roxbury (WR), 02132	23.8	(19.2-28.4)
South End (SE), 02111, 02118	23.0	(18.0-28.0)
Charlestown (CH), 02129	22.9	(16.7-29.0)
Jamaica Plain (JP), 02130	21.6	(17.7-25.5)
Back Bay, Downtown, Beacon Hill, North End, West End (BB), 02108-02110, 02113-02114, 02116, 02199	20.3	(16.3-24.3)
Allston/Brighton (AB), 02134, 02135, 02163	19.6	(15.7-23.4)
Fenway (FW), 02115, 02215	14.5	(9.3-19.6)

DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2017,2019,2021), BPHC



**Figure 5. Hypertension Among Housed and Unhoused Adults, 2021**



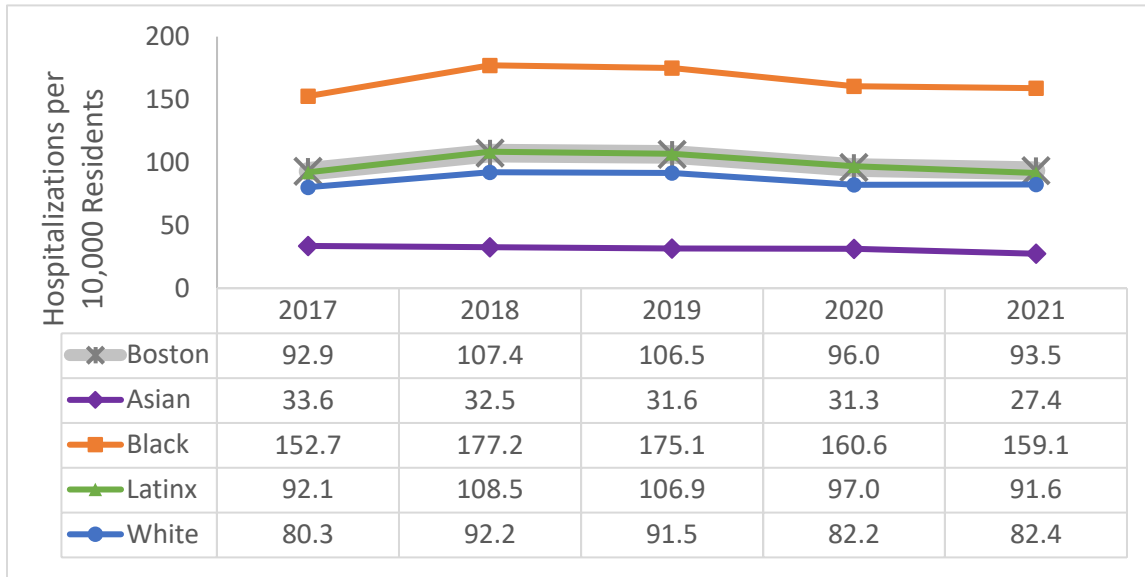
DATA SOURCE: Boston Behavioral Risk Factor Surveillance System (2021), BPHC; Health of Boston Survey of People Experiencing Homelessness, BPHC (2021)

In 2021, a higher percentage of unhoused (i.e., homeless) adults (42.9%) had heart disease compared to housed adults (28.5%).

For more information on the health of Boston's unhoused adults, please see [\*Unhoused and Uncounted: Health of Boston Survey of People Experiencing Homelessness\*](#) or contact the Population Health and Research Office at [populationhealth@bphc.org](mailto:populationhealth@bphc.org).

## SECTION 2. HEART DISEASE HOSPITALIZATIONS

**Figure 6. Heart Disease Hospitalizations† by Race/Ethnicity and Year, 2017 –2021**



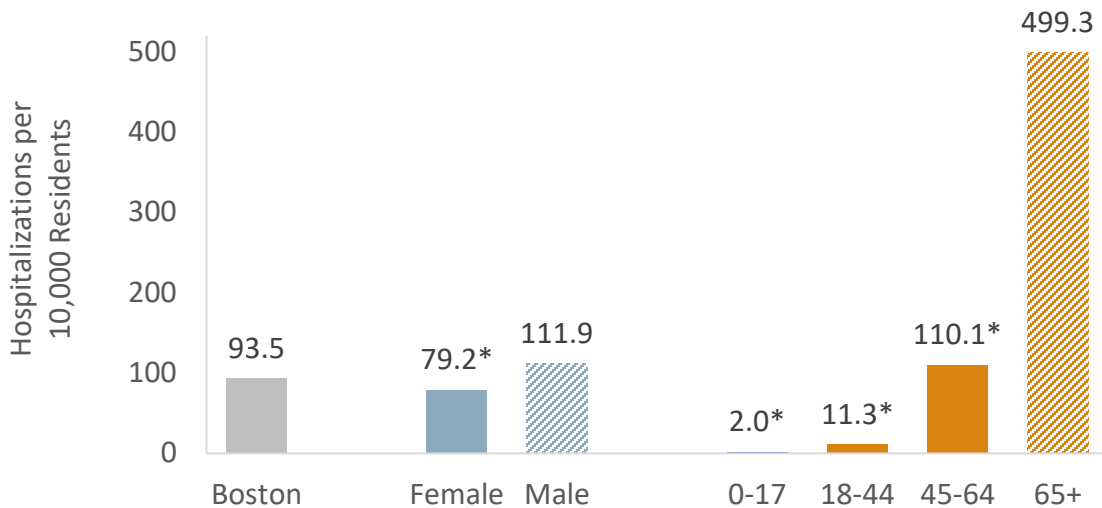
† Age-adjusted rates per 10,000 residents

DATA SOURCE: Acute Hospital Case Mix Database, Massachusetts Center for Health Information and Analysis

From 2017 to 2021, the heart disease hospitalization rate decreased by 4.1% for Boston overall and 16.2% for Asian residents.

In 2021, the rate of heart disease hospitalizations in Boston was 93.5 per 10,000 residents. For 2021, the rate of heart disease hospitalization was 93% higher for Black residents (159.1) and 11% higher for Latinx residents (91.6) compared to White residents (82.4). The rate was 67% lower for Asian residents (27.4) compared to White residents. Rates for 2020-2021 may partially reflect a decrease in hospital utilization due to the COVID-19 pandemic.

**Figure 7. Heart Disease Hospitalizations† by Selected Demographics, 2021**



\* Statistically significant difference when compared to reference group

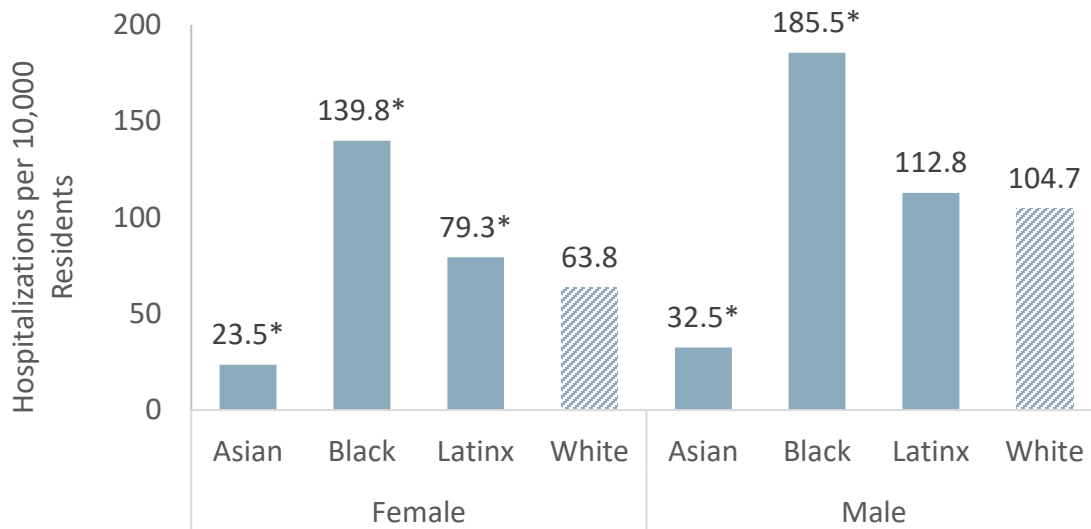
† Age-adjusted rates per 10,000 residents, except for rates by age

NOTE: Bars with hatch marks indicate the reference group within each selected indicator.

DATA SOURCE: Acute Hospital Case Mix Database, Massachusetts Center for Health Information and Analysis

In 2021, the Boston resident rate of heart disease hospitalizations was 93.5 per 10,000 residents. The rate of heart disease hospitalizations was 29% lower for female residents (79.2) compared with male residents (111.9). The rate was lower for all other age groups compared with residents ages 65 and over (499.3).

**Figure 8. Heart Disease Hospitalizations† by Sex and Race/Ethnicity, 2021**



\* Statistically significant difference when compared to reference group

† Age-adjusted rates per 10,000 residents

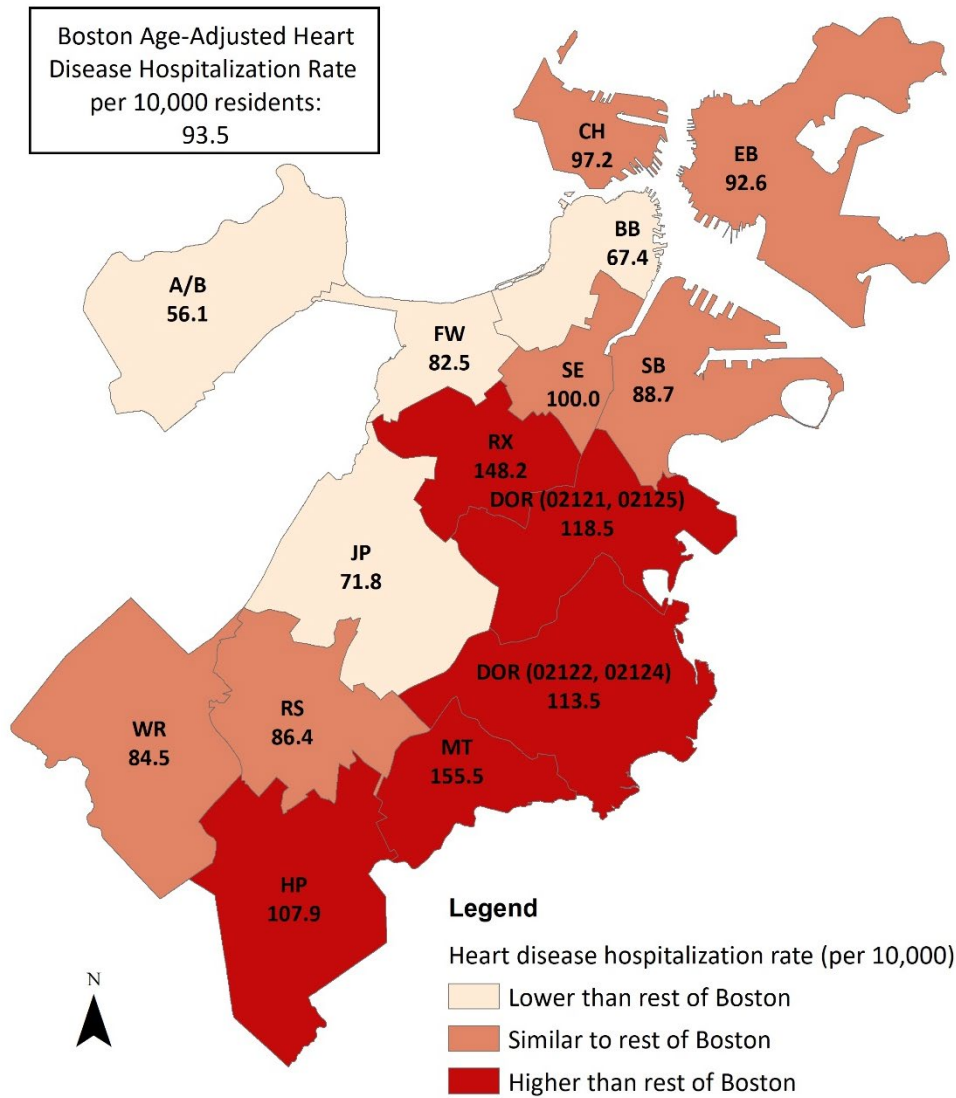
NOTE: Bars with hatch marks indicate the reference group within each selected indicator.

DATA SOURCE: Acute Hospital Case Mix Database, Massachusetts Center for Health Information and Analysis

In 2021, the age-adjusted heart disease hospitalization rate per 10,000 Black female residents (139.8) was 2.2 times the rate for White female residents (63.8), and 24% higher comparing Latinx female residents (79.3) to White female residents. The heart disease hospitalization rate was 63% lower comparing Asian female residents (23.5) to White female residents.

The heart disease hospitalization rate was 77% higher comparing Black male residents (185.5) to White male residents (104.7). The heart disease hospitalization rate was 69% lower when comparing Asian male residents (32.5) to White male residents.

**Figure 9. Age-Adjusted Heart Disease Hospitalizations by Neighborhood, 2021**



DATA SOURCE: Acute Hospital Case Mix Database, Massachusetts Center for Health Information and Analysis

In 2021, the age-adjusted rate of heart disease hospitalizations per 10,000 residents was higher than the corresponding rate for the rest of Boston in Dorchester 02121, 02125, Dorchester 02122, 02124, Mattapan, Hyde Park and Roxbury. The rate was lower than the rest of Boston in Allston/Brighton, Back Bay (includes Back Bay, Downtown, Beacon Hill, and the West End), Fenway and Jamaica Plain. The neighborhood with the highest rate (Mattapan) was over double the neighborhood with the lowest rate (Allston/Brighton).

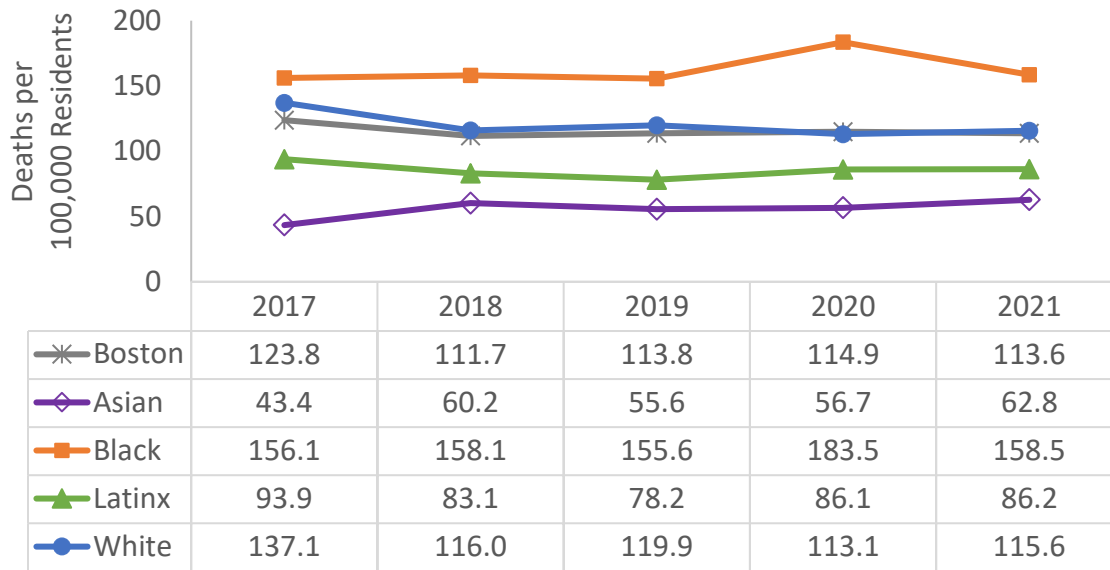
**Table 2. Heart Disease Hospitalizations by Neighborhood, Ranked in Descending Order, 2021**

<b>Neighborhood, Associated ZIP Code(s)</b>	<b>Age-Adjusted Hospitalization Rate</b>
Mattapan (MT), 02126	155.5
Roxbury (RX), 02119, 02120	148.2
Dorchester (DOR), 02121, 02125	118.5
Dorchester (DOR) 02122, 02124	113.5
Hyde Park (HP), 02136	107.9
South End (SE), 02111, 02118	100.0
Charlestown (CH), 02129	97.2
East Boston (EB), 02128	92.6
South Boston (SB), 02127, 02210	88.7
Roslindale (RS), 02131	86.4
West Roxbury (WR), 02132	84.5
Fenway (FW), 02115, 02215	82.5
Jamaica Plain (JP), 02130	71.8
Back Bay, Downtown, Beacon Hill, North End, West End (BB), 02108-02110, 02113-02114, 02116, 02199	67.4
Allston/Brighton (AB), 02134, 02135, 02163	56.1

DATA SOURCE: Acute Hospital Case Mix Database, Massachusetts Center for Health Information and Analysis

### SECTION 3. BOSTON HEART DISEASE MORTALITY

**Figure 10. Heart Disease Mortality Rate† by Race/Ethnicity, 2017-2021**



† Age-adjusted rates per 100,000 residents

NOTE: HOLLOWED-OUT symbols represent rates based on 20 or fewer cases and should be interpreted with caution.

DATA SOURCE: Boston resident deaths, Massachusetts Department of Public Health

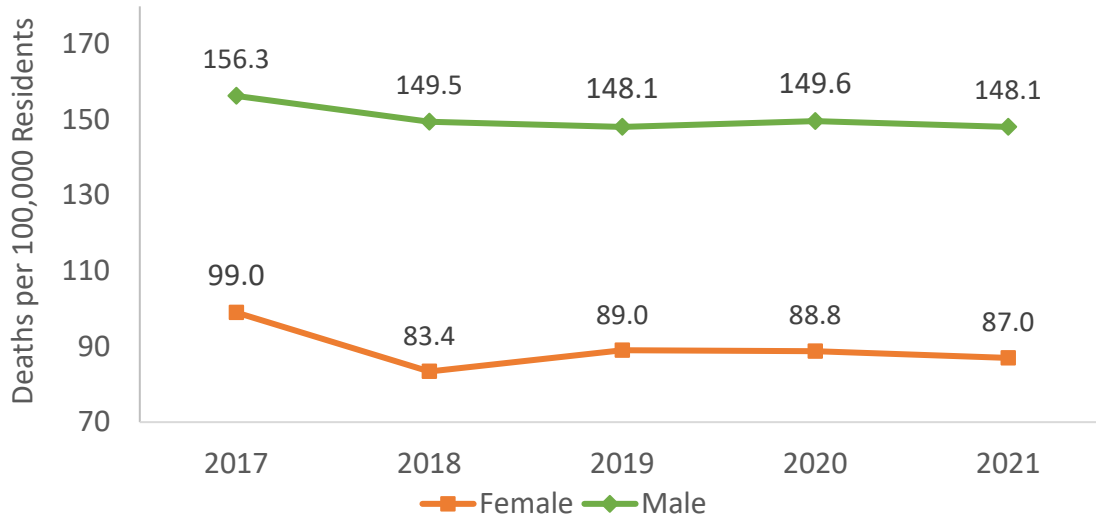
Please be advised that 2020-2021 data are preliminary and subject to change. Raw preliminary data may be incomplete or inaccurate, have not been fully verified, and revisions are likely to occur following the production of these data. The Department of Public Health strongly cautions users regarding the accuracy of statistical analyses based on preliminary data and particularly with regard to small numbers of events. Data may be updated as more information becomes available.

In 2021, the age-adjusted heart disease mortality rate for Boston was 113.6 deaths per 100,000 residents. Between 2017 and 2021, there were no significant changes in the heart disease mortality rates for Asian, Black, Latinx, or White residents.

In 2021, heart disease mortality was 37% higher for Black residents (158.5) compared with White residents (115.6). It was 46% lower for Asian residents (62.8) and 25% lower for Latinx residents (86.2) compared with White residents.



**Figure 11. Heart Disease Mortality† by Sex and Year, 2017-2021**



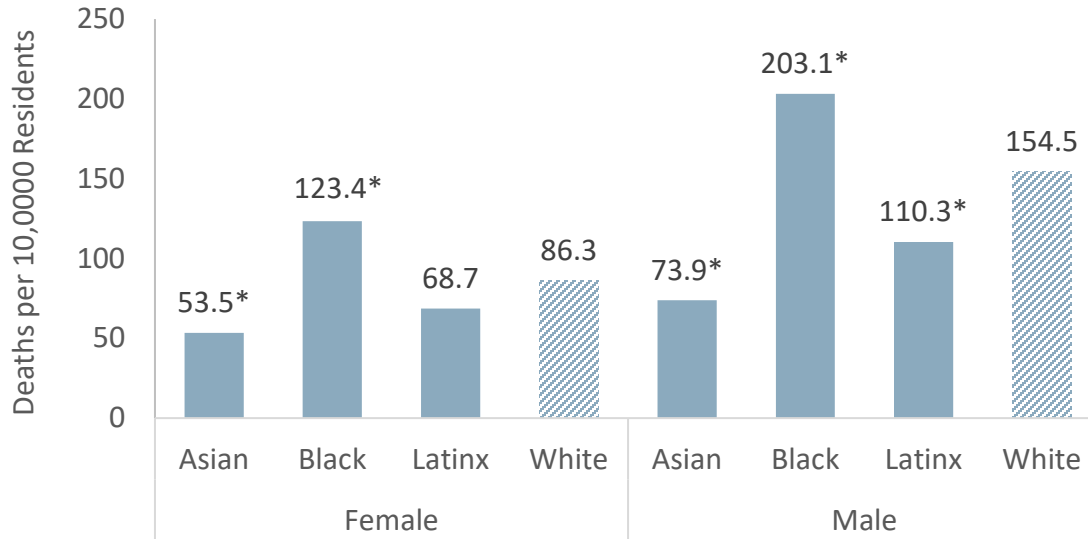
† Age-adjusted rates per 100,000 residents

DATA SOURCE: Boston resident deaths, Massachusetts Department of Public Health

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Between 2017 and 2021, there was no significant change in the age-adjusted heart disease mortality rates per 100,000 residents for either male or female residents. For 2021, the rate for female residents (87.0) was 41% lower than the rate for male residents (148.1).

**Figure 12. Heart Disease Mortality† by Sex and Race/Ethnicity, 2021**



\* Statistically significant difference when compared to reference group

† Age-adjusted rates per 100,000 residents

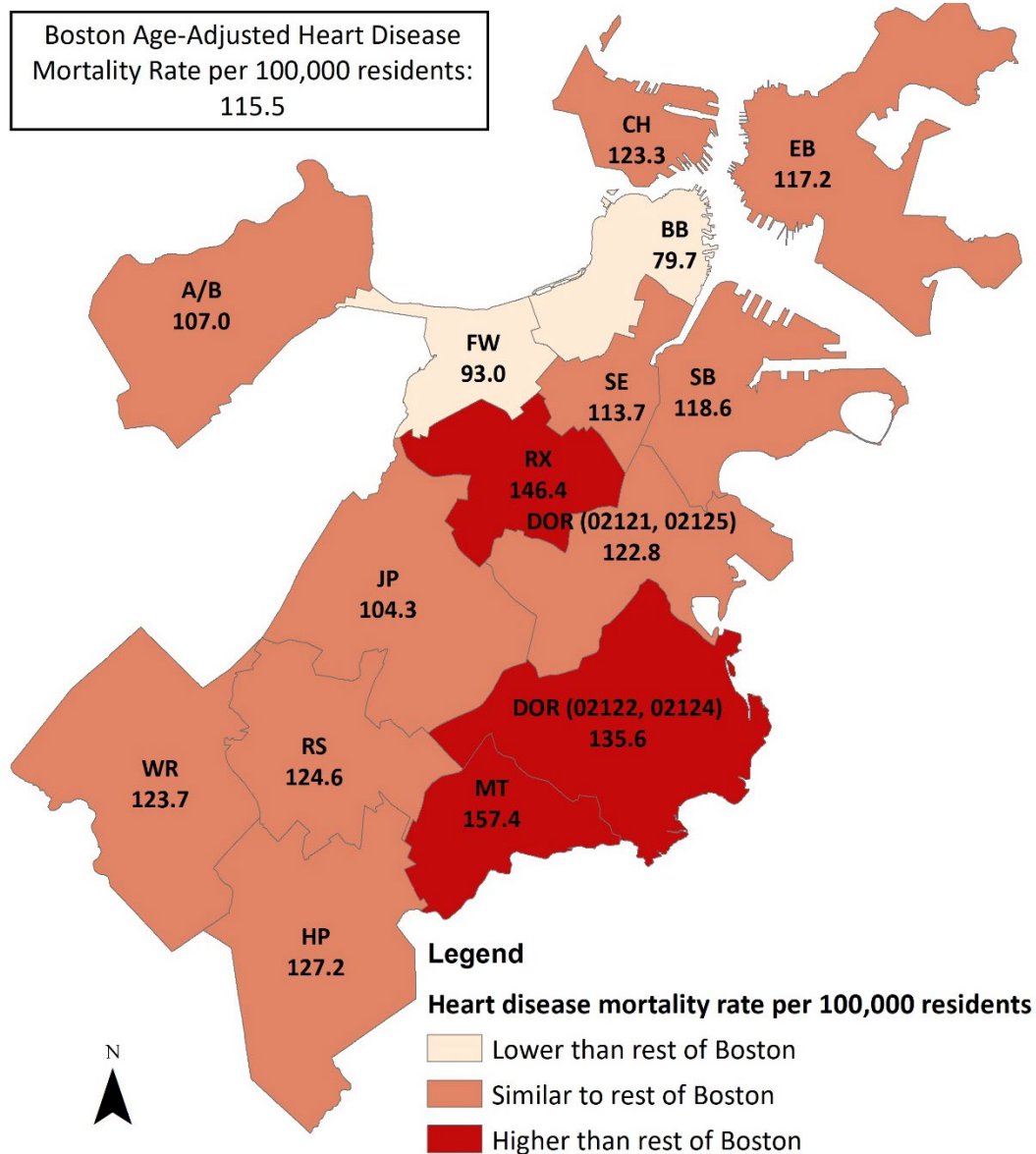
NOTE: Bars with hatch marks indicate the reference group within each selected indicator.

DATA SOURCE: Boston resident deaths, Massachusetts Department of Public Health

Please be advised that 2020-2021 data are preliminary and subject to change. Raw preliminary data may be incomplete or inaccurate, have not been fully verified, and revisions are likely to occur following the production of these data. The Department of Public Health strongly cautions users regarding the accuracy of statistical analyses based on preliminary data and particularly with regard to small numbers of events.

For 2021, the age-adjusted heart disease mortality rate per 100,000 residents was 43% higher for Black female residents (123.4) compared with White female residents (86.3). The heart disease mortality rate was 38% lower for Asian female residents (53.5) compared with White female residents. The heart disease mortality rate was 31% higher for Black male residents (203.1) compared with White male residents (154.5), and 52% and 29% lower for Asian male residents (73.9) and Latinx male residents (110.3), respectively, when compared with White male residents.

**Figure 13. Age-Adjusted Heart Disease Mortality Rate by Neighborhood, 2017-2021 Combined**



DATA SOURCE: Boston Resident Deaths, Massachusetts Department of Public Health

For 2017-2021, the age-adjusted heart disease mortality rate per 100,000 residents was lower for Fenway and Back Bay (includes Back Bay, Downtown, Beacon Hill, West End), compared with the rest of Boston. The rates for Dorchester 02122, 02124, Mattapan and Roxbury were higher compared with the rest of Boston.

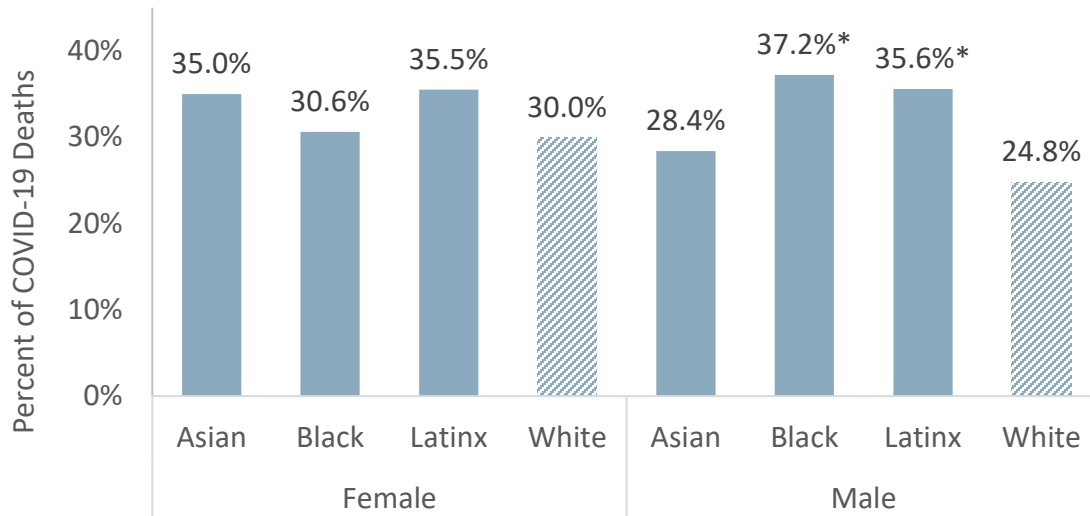
**Table 3. Heart Disease Mortality by Neighborhood, Ranked in Descending Order, 2017-2021**

<b>Neighborhood, Associated ZIP Code(s)</b>	<b>Age-Adjusted Mortality Rate</b>
Mattapan (MT), 02126	157.4
Roxbury (RX), 02119, 02120	146.4
Dorchester (DOR) 02122, 02124	135.6
Hyde Park (HP), 02136	127.2
Roslindale (RS), 02131	124.6
West Roxbury (WR), 02132	123.7
Charlestown (CH), 02129	123.3
Dorchester (DOR), 02121, 02125	122.8
South Boston (SB), 02127, 02210	118.6
East Boston (EB), 02128	117.2
South End (SE), 02111, 02118	113.7
Allston/Brighton (AB), 02134, 02135, 02163	107.0
Jamaica Plain (JP), 02130	104.3
Fenway (FW), 02115, 02215	93.0
Back Bay, Downtown, Beacon Hill, North End, West End (BB), 02108-02110, 02113-02114, 02116, 02199	79.7

DATA SOURCE: Boston Resident Deaths, Massachusetts Department of Public Health

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**Figure 14. Percentage of COVID-19 Deaths with Heart Disease as a Leading Cause, 2020-2021**



\* Statistically significant difference when compared to reference group

NOTE: Bars with hatch marks indicate the reference group within each selected indicator

DATA SOURCE: Boston resident deaths, Massachusetts Department of Public Health

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For 2020-2021 combined, there were 1,152 deaths among Boston residents with COVID-19 as the underlying cause. Among these, 30% identified heart disease as a contributing cause of death.

The proportion of COVID-19 deaths with heart disease listed as a contributing cause varied by race/ethnicity and sex. Among females, 35.0% of Asian, 30.6% of Black, 35.5% of Latinx, and 30.0% of White resident COVID-19 deaths had heart disease as a contributing cause. Among males, 28.4% of Asian, 37.2% of Black, 35.6% of Latinx, and 24.8% of White resident COVID-19 deaths had heart disease as a contributing cause.

## SUMMARY

Black and Latinx adults experienced higher prevalence of hypertension compared with their White counterparts. Prevalence differences were also observed across other demographic and social determinant population groups. Specifically, higher rates of hypertension were observed among adults with less education, who were not employed, who were older, with lower household income, and who lived in publicly supported housing. Elevated rates of adult hypertension were concentrated in Boston neighborhoods known to have relatively higher proportions of such demographics, including Dorchester 02121, 02125, Dorchester 02122, 02124, and Mattapan. These demographics alone do not contribute to increased risk of hypertension and heart disease, rather, social, environmental, and systemic factors (or the social determinants of health) shape and influence the health of communities, and the neighborhoods in which they reside. In other words, neighborhoods with high levels of poverty, unequal access to education, lack of health services, racism, and other social determinants, experience significant health disparities and inequities, which in turn will present as high rates of poor health outcomes, including hypertension and heart disease.

Despite the COVID-19 pandemic, there were no significant changes across time in heart disease hospitalizations from 2017-2021. Across all years, Black residents had a higher rate of heart disease hospitalizations compared to White residents. Similarly, while there were no significant changes in heart disease *as an underlying cause* of mortality over time, Black residents consistently experienced a higher heart disease mortality rate than White residents from 2017-2021. In addition to heart disease as an underlying cause of death, heart disease was identified as a contributing cause of 30% of all COVID-19 mortality during 2020 and 2021.

## GLOSSARY OF STATISTICAL TERMS

**Age-Adjusted Rate (AAR):** Age-adjustment is a statistical process applied to rates of disease and death which allows populations or groups with different age structures to be compared. The occurrence of disease and death is often associated with age, and the age distribution between populations may differ considerably. Thus, AARs are helpful when comparing rates over time and between groups or populations. An AAR is derived by: 1) calculating the age-specific rates (ASRs) across all age groups 2) multiplying by age-specific weights that come from a proportion of the 2000 US standard population within each age group 3) summing the adjusted age-specific rates. In this report, AARs are used for the presentation of heart disease hospitalizations and mortality. All AARs are based on a standard population distribution that covers all ages.

**Confidence Interval:** A range of values based on a chosen probability level within which the true value of a population parameter is likely found. With a 95% confidence interval, one can assume the true value has a high probability of being contained within the interval (i.e., falling between the two values that define the endpoints of the interval).

**Prevalence:** the proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period of time. Prevalence differs from incidence in that prevalence includes all cases, both new and preexisting, in the population at the specified time, whereas incidence is limited to new cases only.

**Rates:** A rate is a measure of a type of event, disease, or condition occurring among a population per unit(s) of time, for instance, the number of deaths due to heart disease per 100,000 population for a given year or across multiple years. Two types of rates are presented in this report: crude rates and age-adjusted rates (AARs). In this report, death rates are based on the primary cause only. The population denominators used for calculating rates is derived through interpolation or extrapolation using data from the 2020 and 2010 US Census. Linear interpolation/extrapolation involves the calculation of an average annual percent change for use in estimating population denominators. Linear interpolation is preferred to using a single year of US Census data when calculating rates for intercensal years.

**Statistical Significance:** An attribute of data based on statistical testing. A statistical test examines differences between rates or percentages to help determine if that observed difference reflects a true difference in the actual population experience, as opposed to one observed simply due to chance. Statistical significance means that an observed difference is most likely true; it does not mean that the difference is necessarily clinically meaningful or important.





## DATA SOURCES

**Boston Behavioral Risk Factor Surveillance System, (Boston BRFSS), Population Health and Research Office, Boston Public Health Commission:** The Boston Behavioral Risk Factor Surveillance System (Boston BRFSS) is a system of telephone health surveys of adults living in non-institutional household settings ages 18 and over that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. The Boston Public Health Commission (BPHC) conducts an independent survey approximately every other year modeled after the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) survey. Over time, the survey has been modified by BPHC to be more reflective of health determinants specific to the Boston population. However, the Boston Behavioral Risk Factor Surveillance System survey has maintained many standard core questions included in the BRFSS used by the Massachusetts Department of Public Health. Results from the survey are used by BPHC to plan and implement health initiatives; to identify health problems within populations; to identify racial/ethnic inequities in access to and utilization of health care, in risk behaviors, and selected health conditions; to establish and monitor health objectives; to support health-related legislative activities; to evaluate disease prevention activities and programs; and to assist in receiving grants and other funding. This report uses Boston BRFSS data from the following years: 2015, 2017, 2019, 2021.

**Health of Boston Survey of People Experiencing Homelessness, Boston Public Health Commission:** The Health of Boston Survey of People Experiencing Homelessness (HOB-SPEH) is a first of its kind comprehensive health survey of unhoused adults (i.e., adults experiencing homelessness as individuals, not as families) conducted in partnership between the Boston Public Health Commission (BPHC) and Boston University School of Public Health. The survey content was heavily based on Boston Behavioral Risk Factor Surveillance System (BBRFSS) survey items, covering a wide range of health topics and social determinants of health, and supplemented with additional items more directly related to homelessness, drug use and housing preferences. The survey was administered from June through August of 2022 among 300 adults utilizing services at BPHC's two emergency shelters (a low-threshold overnight shelter for those experiencing homelessness regardless of substance use) and the Engagement Center (a low-threshold daytime space for individuals navigating homelessness and substance use) located in the Mass and Cass area of Boston. While on a given night the demographic profile of homelessness in Boston is not entirely known, the HOB-SPEH was designed to ensure survey results reflect this *non-family* homeless population across all shelters in Boston. As a consequence, survey results describe racial, ethnic and gender-specific differences among



Boston's unhoused population which subsequently informs the provision of client services and related policy. For more information, please contact the BPHC Population Health and Research Office.

**Acute Hospital Case Mix Databases (Hospital Inpatient Discharge, Emergency Department, and Outpatient Observational Stay Databases), Massachusetts Center for Health Information and Analysis:** These hospitalization data present information on Boston resident hospitalizations to acute care hospitals in Massachusetts. All rates are based on encounter count totals covering fiscal years running October through September (e.g., year 2021 covers HPEs from October 2020-September 2021). For a given hospitalization, the patient's primary diagnosis is used for disease determination.

**Boston Resident Deaths, Registry of Vital Records and Statistics, Office of Data Management and Outcomes Assessment, Massachusetts Department of Public Health:** Death data used by the Boston Public Health Commission pertains only to Boston residents. This report used death data from 2016 to 2021. Death records are completed with the assistance of an informant, typically a family member or funeral director, which may result in errors (for example, in race/ethnicity reporting) that would not occur in self-reported data. Please be advised that 2020-2021 data are preliminary and subject to change. Raw preliminary data may be incomplete or inaccurate, have not been fully verified, and revisions are likely to occur following the production of these data. The Department of Public Health strongly cautions users regarding the accuracy of statistical analyses based on preliminary data and particularly with regard to small numbers of events.

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